

### Abstract

An electrodeionization device for large-volume ultra-pure deionization of water is disclosed. The device comprises a plurality of alternating ion depletion and concentration compartments, interposed between an anode assembly and a cathode assembly, through which flows either a product stream or a waste stream. Each compartment contains several fluid-accessible channels packed with an appropriate ion-exchange medium. The flow of the waste and product streams among the compartments is "parallel" (*i.e.*, contemporaneous). The flow of a stream through the compartments -- *i.e.*, through the channels therein -- is "serial" (*i.e.*, sequential). In an embodiment, electrical current is generated through the compartments using segmented electrodes -- either in the anode and/or the cathode assembly -- that are connected to a single multiple-outlet power source. The device is fast, efficient, robust, and its configuration is comparatively easy to scale upwards to accommodate larger water processing volumes.